Chapter 5— Accreditation

5.1 Definition and Background

Accreditation occurs at a key point in the process to solve a given problem. At this point, the person responsible for accepting the solution determines the model or simulation is sufficient for its intended use. Accreditation is a *decision*—a decision to use a model or simulation for a specific application (i.e., project or program). In fact, any time anyone uses a model to solve even a small, informal problem, a *de facto,* implicit decision (accreditation) is made. For formal programs, however, this decision is explicit. The decision is supported by as much information as is necessary to be credible. According to DoD Directive 5000.59, accreditation is "the official certification that a model or simulation is acceptable for a specific purpose."

Accreditation, then, must be associated with a specific purpose or application. This is what should be meant when someone asks if a model is accredited. At times, the term is used more broadly to cover other activities similar to accreditation. For example, a *class accreditation* is a determination that a model or simulation can apply to a class of applications (e.g., battalion-level armor operations). In this accreditation, a model or simulation is reviewed to determine its overall capabilities to model a segment of the battlespace. Even with a class accreditation, however, an accreditation must be performed when a specific application is defined for the model's or simulation's use. Another name for class accreditation is *capabilities assessment*.

In addition to the accreditation to use a model for a specific application, many decision makers also will examine the credibility of a model's or simulation's results, a process referred to as *results accreditation*. Results accreditation is usually done by both Modeling and Simulation (M&S) and subject-matter experts who review the results to determine their correctness.

At times, the overall application for the model or simulation will be critical and will have high visibility. In this instance, levels of management above the primary model or simulation user may make additional accreditations. These multiple accreditations give assurance to those higher levels of management that the model or simulation to be used is

appropriate.

Because other activities are associated with accreditation, the best answer to the earlier question about model accreditation may be "What do you mean by *accredited*?"

The remainder of this chapter uses the term *accreditation* in its basic sense: the decision to use a model or simulation for a specific application. The next sections discuss the role of accreditation in the overall application process, the process that is used to support an accreditation, and the participants in accreditation and their responsibilities.

5.2 Accreditation's Role in the Overall Application Process

The overall application process is shown in Figure 5-1. As indicated in Chapter 1, Section 1.3, and Chapter 3, Section 3.3.1, the problem statement (or program product) drives the requirements and the selection of the approach to solving the problem (or developing the product). This approach may include the use of M&S. If so, those problem requirements to be addressed by M&S drive the M&S approach. An initial step in the M&S approach is to determine the M&S capabilities needed to address the requirements appropriately. These capabilities are acceptability criteria to be applied at initial model or simulation selection as well as during the acceptability assessment.

The team that selects the model or simulation to be used screens the M&S candidates against an initial set of acceptability criteria. The screening process compares the capabilities needed against the documented functionality of each M&S candidate. Based on this screening process, the team selects a set of models or simulations that provides the best chance of satisfying the requirements of the problem or project. Note the use of the word *chance*. M&S, like any other tool or methodology, has a probability of not working correctly. Causes of failure include errors inherent in the model or simulation (none is perfect), inaccurate model or simulation documentation, and problem requirements or characteristics that become apparent after the beginning of the application process. To minimize the chance of inaccurate results, project delay, or failure, steps should be taken to enhance the credibility of (the degree of confidence in) the model or simulation selected for this application. These steps include Verification and Validation (V&V) of the model's or simulation's functions important to the application as well as assessment of the model's or simulation's general characteristics to ensure they can satisfy project needs. The savvy application sponsor will check at key points of the overall application process to ensure each of these steps has been carried out correctly before proceeding to the next step.

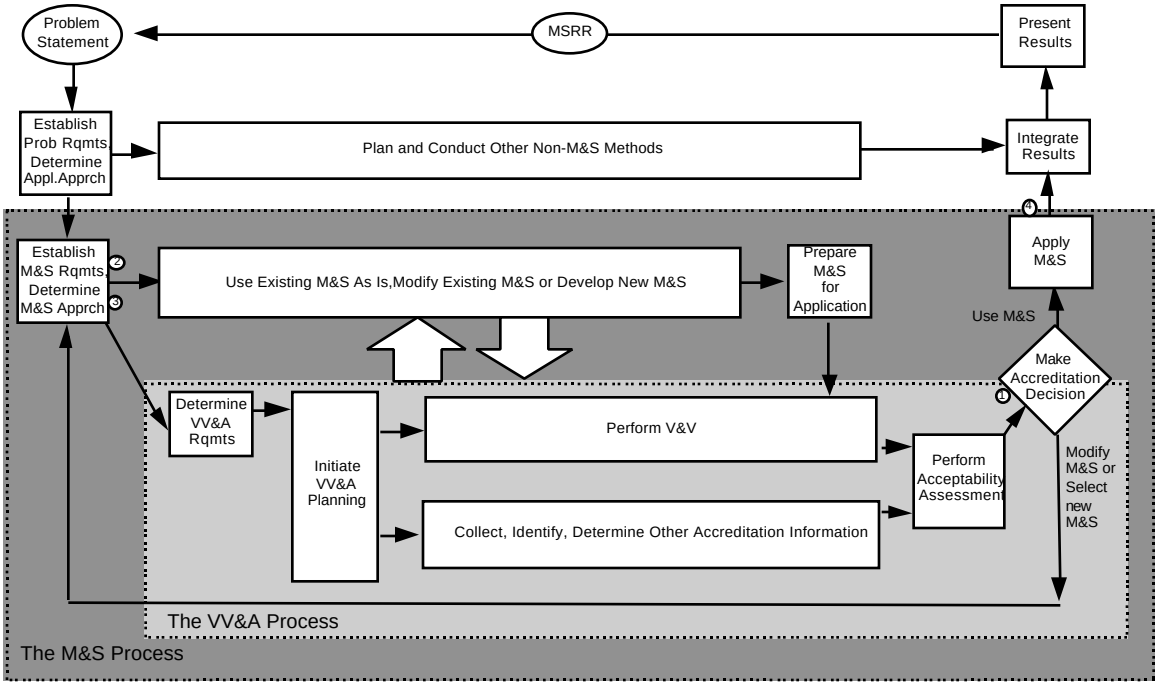

Figure 5-1. Verification, Validation, and Accreditation (VV&A) in the Application Process (Scheme of Things)

As a minimum, the sponsor should check when the acceptability assessment has been done and the recommendation for model or simulation use has been made, "circle" 1 in Figure 5-1. At this point, the accreditation authority decides to accept the model or simulation suite for use as is, to accept it for use with limitations, to use it only after enhancements have been made to the suite, to direct that additional V&V be performed, or not to use the model or simulation at all. Other points at which the accreditation authority or application sponsor may review and approve the work are when the M&S acceptability criteria have been developed ("circle" 2), when the initial model or simulation suite has been selected ("circle" 3), and when the M&S results have been generated ("circle" 4).

These checks give the application sponsor confidence that the M&S process will produce the results needed and that the M&S process is being carried out correctly. The greater the criticality of the overall application or the greater the inexperience with the model or simulation used, the more an application sponsor should review and approve critical process steps.

5.3 Process to Support Accreditation

This section describes the process leading up to and supporting accreditation. This process is shown in the boxes not shaded in Figure 5-2. Note that it encompasses the V&V process. For an application, V&V is a part of the accreditation process.

5.3.1 Accreditation Requirements

The accreditation process begins with the determination of accreditation requirements, based on the acceptability criteria developed in selecting the M&S approach. These requirements include the V&V requirements as well as other M&S characteristics needed and constraints based on application limitations. The process for determination of the V&V requirements is discussed in detail in Chapter 3. An overview of this process follows.

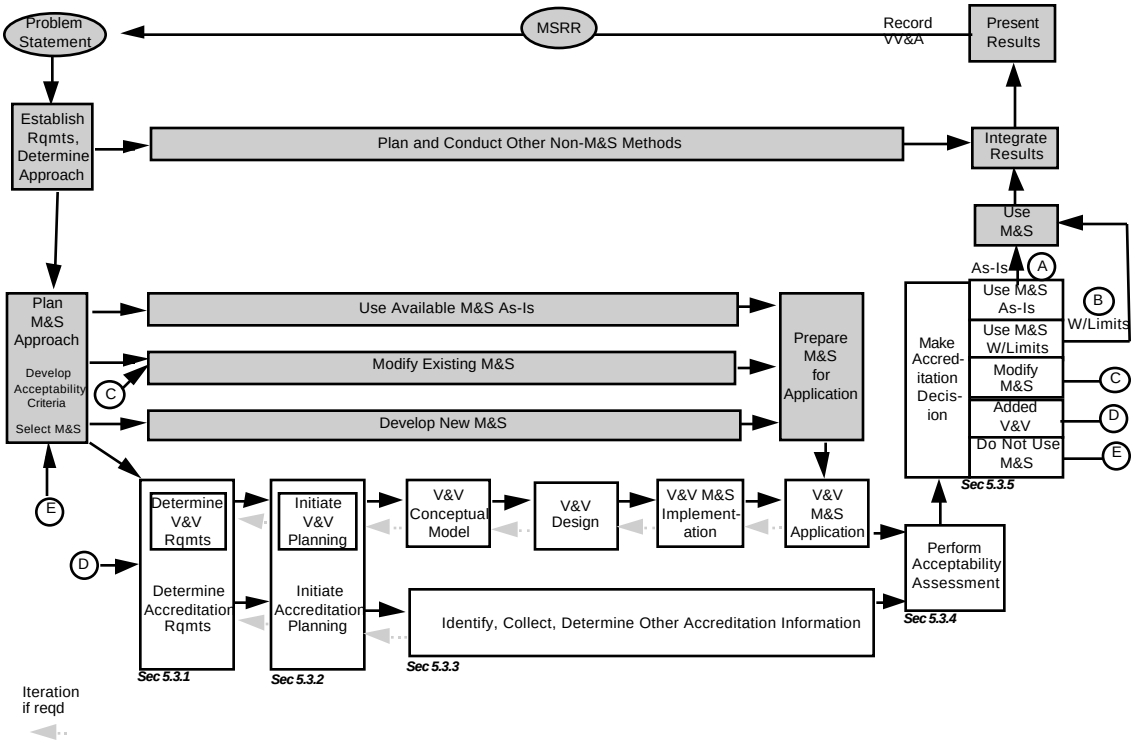

Figure 5-2. Process to Support Accreditation

The V&V requirements are determined first by defining the key M&S functions derived from the acceptability criteria. (These functions actually should have been determined as part of the earlier process to develop the acceptability criteria.) These key functions are prioritized in order of importance to the application. The V&V status of each of the key functions is then determined. The V&V status reflects whether V&V has been performed on this M&S function, the quality of the V&V performed, and the actual V&V findings. If the V&V status of a M&S function is sufficient for this application, no further V&V is required. If no V&V has been performed or the V&V accomplished is insufficient for this application, then a V&V requirement is generated. The sum of the V&V requirements for each key function makes up the initial V&V requirements for the application. The priority of the key function, and thereby the V&V requirement, can guide the V&V planner in determining the V&V that is to be accomplished, and potentially, in what sequence.

Other accreditation requirements include M&S characteristics that can affect the decision for the model's or simulation's approval and use. These factors include (a) model or simulation development and use history, (b) operational environment requirements, (c) configuration management status, (d) documentation status, and (e) other known capabilities and limitations of the model or simulation and supporting data bases.

An initial set of accreditation requirements, both V&V and non-V&V, is often used in the model or simulation selection process. For example, a model or simulation with a large set of V&V requirements is less likely to be selected over another model or simulation of similar capabilities with fewer V&V requirements.

The model or simulation development and use history is often a consideration for an accreditation authority in that an existing model or simulation with significant recent application use has more credibility than a new one with no history. The factors in development and use history are presented in Tables 5-1 and 5-2.

For many of these M&S development and use factors, the consideration is typically subjective and used in a comparative way. For example, one model or simulation may be a better choice than another because it was developed by an organization with extensive M&S development experience whereas the second was developed by an organization with little or no M&S development experience.

The M&S operational environment requirements are also a consideration for model or simulation selection and use because of the significant impact they can have on the resources required: facilities, time, and personnel. The factors in Table 5-3 are important for operational environment consideration.

Table 5-1. Developmental Factors to Consider

Development Factor	*Accreditation Consideration*
Initial model or simulation developers	Developer's reputation and SEI rating; M&S development experience
Development sponsor and reason for initial development (i.e., project, study)	Scope of sponsor's mission; scope of initial project or study requirements
M&S development methods applied	Good M&S development standards imply more efficient code and structure with fewer errors
Major M&S modifiers	Modifier's reputation and SEI rating; M&S modification experience
Modification sponsor	Scope of sponsor's mission
Reason for modification	Error correction or new capability added
M&S modification methods applied	Good M&S modification standards imply more efficient code/structure with fewer errors

For each major application, the factors in Table 5-2 apply.

Table 5-2. Use Factors to Consider

Use Factor	*Accreditation Consideration*
Major application description	Similarity of purpose and scope
Application sponsor	Scope of sponsor mission
Time frame of application	Currency of use
Critique of model or simulation use in application	Limitations discovered, operational problems, unexpected delays or problems, data base problems, overall success of model or simulation application

A third major factor to be considered for accreditation is the configuration management status of the model or simulation and its associated data bases. For a model or simulation to be usable by an application, it should be under competent configuration control. For the typical major DoD model or simulation, configuration management responsibility lies with the model's or simulation's proponent. Often, the sponsor leads a configuration control board with major model or simulation users as board members.

Table 5-3. Operational Environment Factors to Consider

Operational Environment Factor	*Accreditation Consideration*
Necessary hardware configuration needed to run the simulation including host type, processor speed, storage and storage devices, telecommunications links	Availability, cost, and scheduling of the necessary facility and configuration
Necessary software environment including operating system, language processors, data base systems, support software, display software	Availability and cost of obtaining, installing, or modifying software; availability and cost of personnel to make any software enhancements
Necessary personnel for model or simulation operation including number and experience level for model or simulation input data preparation, simulation execution and output analysis	Availability and cost of appropriate personnel including training
Necessary security including physical security of facility, data base security, personnel clearances	Cost of physical security; availability and cost of personnel with the appropriate clearances; time needed to obtain additional clearances

If configuration management has not been effective, a user cannot know what version of the model or simulation the application is using or what code, hardware, and data are really being used. Lack of configuration management may allow modifications to a model or simulation during an application without consideration of impact on overall operations.

Another major factor to be examined for accreditation is the model's or simulation's documentation. This factor relates to configuration management. Good configuration management usually implies good documentation. Poor or no configuration management leaves any M&S documentation suspect in terms of currency. The model's and simulation's documentation should have breadth (types of documentation, e.g., operator's manual, analyst's guide), depth (detail of documentation), accuracy, and currency (the model's or simulation's documentation matches the version being used).

A final major factor for accreditation is to review known limitations or problems with the model or simulation. A good configuration management system has such a list readily available. Other sources of this information are past or current users.

All these factors are possible considerations for the accreditation authority. Some or all of them may be appropriate for any specific application. Factors are selected to become accreditation requirements based on their perceived importance in making a credible accreditation decision as well as the estimated cost and time needed to gather the

information. The appropriate Model and Simulation Resource Repository (MSRR) should have much of this information. As accreditation requirements are selected, they should be ranked, based on their priority to the application and on their importance to the accreditation authority.

5.3.2 Accreditation Planning

The application-specific accreditation requirements are satisfied based on the accreditation plan. The plan contains the list of requirements to be satisfied, the method of meeting each requirement, the agent responsible for each requirement, the overall resources needed, and the schedule for satisfying the requirements. A major subset of the accreditation plan is the V&V plan. Usually, this is a separate plan because it is the major work to be accomplished. It may be done by a group different from that satisfying all non-V&V requirements because of different skills or levels of expertise needed. The V&V planning process is discussed in more detail in Chapter 3.

Each requirement is examined, and the optimum method of requirement satisfaction is selected. The optimum is based on a trade-off of cost, resources, and time to complete. Each requirement satisfaction method then is grouped appropriately and integrated to give an overall approach to meeting the requirements. Requirements that drive the cost, resources, or schedule are re-examined to find more efficient ways of satisfying them. If no alternative can be found for a requirement that is excessively costly or time consuming, it should be reconsidered. Based on its priority, the requirement can be accepted as is, reformulated to make it easier to accomplish, or eliminated. Once the methods for all requirements are accepted, an integrated resource list and schedule is developed. If the V&V requirements are to be accomplished through a separate plan, they are documented separately. The approach to meeting all requirements is documented in the accreditation plan.

5.3.3 Accreditation Plan Execution

Once the accreditation plan has been approved, satisfaction of the requirements may begin. Chapter 3 provides a detailed description of the processes involved in V&V. The non-V&V requirements are met using the methods specified in the accreditation plan. These methods usually involve identifying sources of and collecting information, which should be documented. If execution of the accreditation plan is long or detailed, interim reports and reviews of progress may be appropriate.

5.3.4 Acceptability Assessment

The acceptability assessment reviews all accreditation information, both V&V and non-V&V, and develops a list of capability voids, weaknesses, and mismatches of model or simulation functions and characteristics versus application acceptability criteria. The acceptability assessment team usually consists of the accreditation team and the V&V team, if it is separate. If modifications to the model or its data base are necessary to fill voids or correct weaknesses, approaches to these modifications along with the resources required and a schedule are developed and documented. If the voids or weaknesses can be avoided by limiting the uses of specific models or simulations, these limitations are documented. If there is a potential, yet undetermined weakness because of a lack of V&V, the additional V&V needed to determine if the weakness exists is estimated in terms of resources and time. The capability voids and weaknesses are analyzed together to develop an overall recommendation for model or simulation use, model or simulation use with limitations, model or simulation modifications, additional V&V, or model or simulation rejection. The results of the acceptability assessment and the recommendation with its rationale are documented in the acceptability assessment report and briefed to the accreditation authority.

5.3.5 Accreditation

The accreditation authority then has the responsibility to review the results of the acceptability assessment and, based on that information as well as other factors, make a decision. Among the other factors the accreditation authority may consider are a projected program schedule slip (for an acquisition program) or an anticipated budget decrease (or increase). The accreditation authority may ask the acceptability assessment team to develop additional information or different approaches to fill voids or eliminate weaknesses in a model's or simulation's capabilities before a decision is made. The decision can be one or a combination of the following:

(A) Use the model or simulation as it is for the application.
(B) Use the model or simulation with limitations in that use.
(C) Modify the model or simulation before use.
(D) Perform additional V&V.
(E) Do not use the model or simulation for this application.

Alternatives C through E incur additional costs and cause schedule changes. Alternative E is the most severe because it causes the process to begin again at developing the M&S

approach.

The accreditation decision should be documented in a short report signed by the accreditation authority. At this point, the decision maker also should release the developed accreditation information to the MSRR to support future M&S applications.

5.3.6 Accreditation Process Tailoring

The process to support an accreditation decision is tailored to fit the needs of the accreditation authority or application sponsor and the application. For an application that is low in cost, with little national or DoD impact, or that produces results to be used in a low-level study, the credibility that the M&S tool used must possess is low. Hence, the accreditation requirement can be as simple as determining if the accreditation authority or application sponsor has used the M&S tool for a similar application. No VV&A planning is required, no acceptability assessment need be done, and the accreditation decision can be documented in a memorandum. On the other hand, for an acquisition program that has major, long-term budget implications and that will produce a significant new weapons system capability, the accreditation effort may use all the types of accreditation requirements described here, have a number of review and approval points, generate multiple interim reports, and have a large accreditation budget. Most applications fall somewhere between these extremes, and judgment will have to be used to assess the size of the accreditation effort correctly.

Other factors are considered in determining the size of the accreditation effort. For a given application, if a selected model or simulation has been recently and successfully used for a similar effort and the model's or simulation's configuration is well managed, then the results of the previous accreditation effort can be credibly relied on. A model or simulation well-established (documented) in the MSRR also makes information-gathering a relatively simple and easy task. For this reason, putting the basic model or simulation documentation, V&V information, and history of use in the MSRR is very important.

5.4 Roles

Any application has a number of key personnel roles. Table 5-4 summarizes these roles and responsibilities.

For some applications, some of these roles can be assumed by the same person. For example, the accreditation agent can also be the V&V agent. The number of people involved is a function of the size of the application and the amount of M&S to be applied.

Table 5-4. Personnel Requirements

Role	*Responsibility*
Accreditation Authority or Application Sponsor	Makes the accreditation decision; responsible for use of the M&S results and the overall application
Accreditation Agent	Manages the accreditation effort for a specific application; reports to the Accreditation Authority
V&V Agent	Manages the V&V effort for an application; reports to Accreditation Agent.
M&S Proponent	Responsible for development, modification, documentation, M&S configuration management, and V&V within a specific area of interest

5.5 Summary

The process leading to accreditation provides confidence to the application sponsor that the model or simulation can produce the results needed to develop the application's product. The magnitude of this process depends on the criticality of the application, the size of the M&S support for the application, and the amount of VV&A previously done for the selected model or simulation.